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DENTAL RADIOGRAPHY ANALYSIS USING YOLOV8 DEEP LEARNING USING RASPBBERY PI DEVICE

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Abstract

This research paper presents a deep learning-based model using YOLOv8 to detect abnormalities in panoramic dental radiographs. In the course of this experiment, we used the currently widely used Raspberry Pi device and achieved the result by deep learning using the above model.

Keywords: *deep learning, YOLOv8, Raspberry Pi, model, object detection, images, problems, medical.*

Introduction. Today, one of the problems facing medical workers of our Republic is the development of the field, adaptation of the medical system to world standards, strengthening of health care and protection of the oral cavity. According to WHO, about 15% of the world's population are screen people. Caries is a common dental disease among children, and according to the latest epidemiological intelligence, in vulnerable children aged 12-15 years, among dental diseases - caries accounts for 63.3-88.7%. In addition, 37.8% to 50% of periodontal tissue diseases in 12 years. - in mentally retarded children, and in 15-year-old children from 57.7% to 84.7%.

President Shavkat Mirziyoyev, in his meetings with young researchers, heads of research institutions and medical representatives, emphasizes that prevention is more effective and gives better results than treatment

Nowadays, dental caries is one of the most common diseases and diseases, and 95-98% of the world's population can be infected with pure caries. Against the production of many preventive methods against caries, there are many cases of infection with oral diseases among the population, especially among children.

Currently, the following works have been carried out in this area. Adopt a convolutional neural network (CNN) system. Of the 598 intraoral images collected, 402 were for training and 196 were for testing. The model used is a sequential model that classifies the images into three classes, Normal Teeth, Caries, Oral Cancer. The accuracy determined in the tested dental photographs was 83-94%. It helps in the early diagnosis of oral problems that are clearly defined by the three dentists. This helps the dentist diagnose dental health problems efficiently and accurately.[1]

Through the experiment, we conclude that the 5-axis recognition model proposed in this study will be an important foundation for the dental X-ray image-based diagnosis model in the future. Future research could extend the scope of the 5-axis recognition model by using different recognition approaches. In addition, such studies will help to widely apply the proposed 5-axis model in various tasks that occur in the field of computer-aided diagnostics.[2]

This pilot study uses a small dataset of 664 dental panoramic x-rays to find different dental diseases and their treatments. To install after three images are manually labeled for 9 classes. You Only Look Once (YOLO) version 5, the first ever real-time object detection method, is a deep neural network embedded in the validation. Boundary boxes helped refine the six differential treatments into three classes of dental disease. The results show that this strategy was a success with 1.00 precision, 0.74 F1 score, 0.83 recall and 72.4 percent mAP, which is a great development for dentists and radiologists to see.[3]

For this study, the YOLO8 learning model shows promising targets in the classification of dental diseases such as cavities, periodontal production and oral cancer with 82 36% accuracy. By training the model on a dataset of adult dental radiographs, it can accurately identify possible dental diseases, leading to earlier and more ef fective results.[4]

Nowadays, the following scientists can be observed in their scientific research in India and other European countries Kumar, S., Rani, S., & Singh, R Mohan, R., Arunmozhi, R., & Rajinikanth, V. Y. P, Marin, J. H., Holguin, E. H., Yanqui F. T., & Cabrera, M. I. Thanks to the effective results of the research conducted in Uzbekistan, we tried to conduct a number of scientific researches.

RESEARCH METHODOLOGY

Panoramic dental x-ray images are often used to obtain health problems and to obtain a past x-ray examination to obtain radiation levels and past x-ray quality images are improved first.[4]

1. Quality and high quality product for noise removal.
2. Manual filter given table.

searches using the lookup table given by the filter
searches using the lookup table given by the filter

$$[(j/225)^{(-1,5)}]*225$$

the brightness and contrast of the image is automatically determined using the following formula

$$output=a*input+b$$

where the alpha and beta sides are given

$$a=(a_max-a_min)/(a_high-n_low)$$

$$b=a_min-a_iow$$

$$a_max\ 255$$

$$a_iow-0$$

the lowest pexel value in the image - a_high
the highest value pexel in the image - a_low



Fig. 1. Wide filled image

Segmentation

A panoramic dental x-ray includes areas outside the jaw, making it extremely difficult and time-consuming to separate the teeth. To overcome this complication and shorten the process, automatic segmentation of the jaw is required. Segmentation of the jaw is still difficult due to the lack of significant difference in pixel intensity between different components and the lack of clear edges in panoramic radiographs. The segmentation is divided into three parts: removal of the jaw area, separation of the upper and lower jaws, and vertical segmentation of the upper and lower jaws.[4]

Jaw are a removal

1. Scan the row from halfway to the end of the columns to locate the jaw
2. Find the middle of the black part of the three lines.
3. For the remaining top rows, look for the leftmost black pixel of the next row toward the middle.
4. Mark the leftmost black pixel as the point around the jaw.
5. If the process stalls, the three sections after the midpoint are the volume of the product.
6. Repeat this procedure for the left part of the jaw. repeat the same procedure for the left part of the jaw.
7. If the distance directly above or above any point is greater than 4, the point check can be set to the mean point.
8. Draw an ellipse with an incident.

Draw an ellipse with an incident.

$$Center=((x_max+x_min)/2,(y_max+y_min)/2)$$
$$H_eight=(y_max-y_min\ )*0,9$$
$$v_mendth=2*H_eight$$

x_max, x_min = maximum and minimum value of the x-axis on the boundary line of the segmented are a y_max , y_min = maximum and minimum value of the y-axis on the boundary line of the segmented are.[4]

9. A mask is produced using an ellipse to obtain the jaw are a.

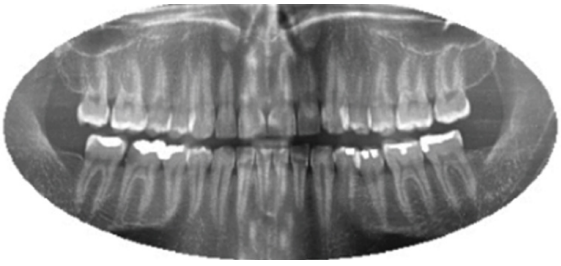


Figure 2. Extracted jaw area

A panoramic dental X-ray has a large field of view with a load of data even after removing the jaw area. We use an algorithm to load that area and use the upper and lower jaw

1. Divide the picture into columns / 10 equal parts.
2. Adjust the weight to 2 for each pixel values less than 100 and 0 and greater than 100.
3. Add the sum values and find the row with the minimum value
4. Identify the appropriate row and column.
5. Spotting: If the forward distance of any point is greater than 20, mark it as a spot.
6. set the curve through the points determined by the equation.y= a*x^2+ b*x + c
7. Extend the curve to both ends of the image.
8. Make two copies of the line 70 units up and 70 units down
9. Top and clothes Specially craft two masks for the jaws and get the top and jaws for the masks.



Figure 3. Upper jaw are a.

The above output was fed to a raspberry pi device and the following output was obtained.

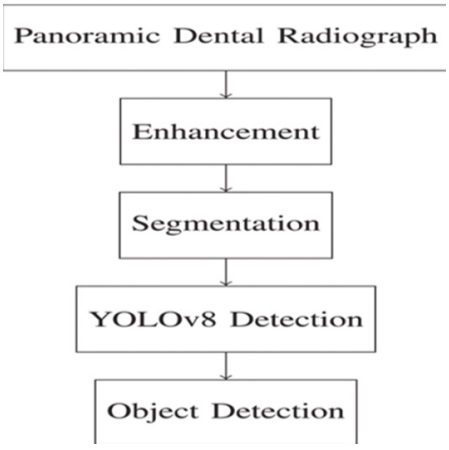


Figure 4. Block diagram of the proposed method.

Using the above model, we ran a deep dive using the now widely available device Raspberry pi and got the following result.



Figure 5. the device used to obtain the result Raspbbery pi

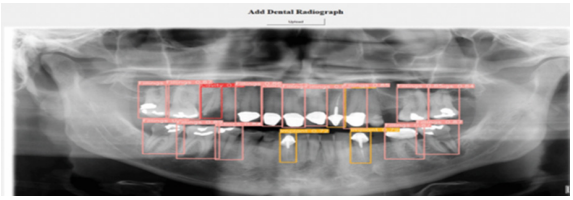
Program code:

```
import cv2
videoCapture=cv2.VideoCapture(0)
while True:
    ret,frame=videoCapture.read()
    frame=cv2.flip(frame,1)
    # frame=cv2.resize(frame, (0, 0), fx = 0.77, fy = 0.77)
    maxHeight, maxWidth = frame.shape[:2]
        img1=cv2.GaussianBlur(frame, ksize=(17, 17), sigmaX=0, sigmaY=0)
        img1=cv2.putText(img1, "Размытый по Гауссу", (22,44),cv2.FONT_HERSHEY_COMPLEX,1.1,(0,0,255),2,cv2.LINE_AA)
    img2=cv2.cvtColor(frame,cv2.COLOR_BGR2HSV)
        img2=cv2.putText(img2, "COLOR_BGR2HSV", (22,44),cv2.FONT_HERSHEY_COMPLEX,1.1,(0,0,255),2,cv2.LINE_AA)
    img3=cv2.convertScaleAbs(frame, 1, 2.2)
        img3=cv2.putText(img3, "Изменение яркости", (22,44),cv2.FONT_HERSHEY_
```

```
COMPLEX,1.1,(0,0,255),2,cv2.LINE_AA)
        frame=cv2.putText(frame, "Оригинал", (11,33),cv2.
FONT_HERSHEY_COMPLEX,1,(0,0,255),2,cv2.LINE_AA)
        list=[img1,img2,img3]
        # for i in list:
        #     i=cv2.resize(i, (int(maxWidth / 3), int(maxHeight
/ 3)))
        list=cv2.hconcat(list)
        list=cv2.resize(list, (maxWidth,int(maxHeight/3)))
        cv2.imshow("OBI",cv2.vconcat([frame,list]))
        key=cv2.waitKey(1) & 0xFF
        if key==ord("q"):
            break
    cv2.destroyAllWindows()import cv2

    videoCapture=cv2.VideoCapture(0)
    while True:
        ret,frame=videoCapture.read()
        frame=cv2.flip(frame,1)
        # frame=cv2.resize(frame, (0, 0), fx = 0.77, fy = 0.77)
        maxHeight, maxWidth = frame.shape[:2]
            img1=cv2.GaussianBlur(frame,  ksize=(17,  17),
sigmaX=0, sigmaY=0)
                    img1=cv2.putText(img1,  "Размы-
тый  по  Гауссу",  (22,44),cv2.FONT_HERSHEY_
COMPLEX,1.1,(0,0,255),2,cv2.LINE_AA)
        img2=cv2.cvtColor(frame,cv2.COLOR_BGR2HSV)
                    img2=cv2.putText(img2,  "COLOR_
BGR2HSV",                (22,44),cv2.FONT_HERSHEY_
COMPLEX,1.1,(0,0,255),2,cv2.LINE_AA)
        img3=cv2.convertScaleAbs(frame, 1, 2.2)
                    img3=cv2.putText(img3,  "Измене-
ние  яркости",  (22,44),cv2.FONT_HERSHEY_
COMPLEX,1.1,(0,0,255),2,cv2.LINE_AA)
        frame=cv2.putText(frame, "Оригинал", (11,33),cv2.
FONT_HERSHEY_COMPLEX,1,(0,0,255),2,cv2.LINE_AA)
        list=[img1,img2,img3]
        # for i in list:
        #     i=cv2.resize(i, (int(maxWidth / 3), int(maxHeight
/ 3)))
        list=cv2.hconcat(list)
        list=cv2.resize(list, (maxWidth,int(maxHeight/3)))
        cv2.imshow("OBI",cv2.vconcat([frame,list]))
        key=cv2.waitKey(1) & 0xFF
        if key==ord("q"):
            break
    cv2.destroyAllWindows()
```

result:



Summary

In this research work, we achieved the results by deep learning on Raspberry pi device. present a deep learning-based model using YOLOv8 to detect abnormalities in panoramic dental radiographs. A user-friendly GUI has been developed to facilitate the detection process. The GUI provides an intuitive platform for dentists to interact with the model, allowing for seamless integration into their diagnostic workflows. Future work will include additional classes to expand the dataset and better identify different dental anomalies. This research demonstrates the potential of deep learning in revolutionizing dental diagnostics, with further advances expected through dataset expansion and class diversification.

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